REMARKS

The Office Action of September 11, 2003 has been carefully studied. The claims in the case are 1-21, with claim 21 being newly added. No claim is yet to be allowed. The present amendment provides amendments to claims 1, 7 and 13-20.

The following paragraphs correspond to the order of the paragraphs of the Office Action:

35 U.S.C. 112 Second Paragraph

Claims 13-15 are amended so as to replace "nm" by --mm--. The Examiner is thanked for noting this error. Also, the circa signs are replaced by "about" in accordance with the Examiner's suggestion.

With respect to claims 18-20, Applicant respectfully points out that it is the particles which are deposited in the layer thickness set forth in the claims. A layer of a suspension on the other hand would necessarily be larger in thickness since water is filtered from the suspension so as to obtain the crystalline homogeneously packed monospheres. In this connection, it is seen that claim 1 is amended extensively, based on the discussion in the specification, for example on page 3, line 7 and page 5, line 13. Accordingly, the emphasis in the claim is now properly placed on the obtaining of crystalline homogeneously packed monospheres and this is accomplished by moving a water suspension of the monospheres on the moving bed filtration membrane substantially horizontally over a vacuum filtration zone, and applying a sufficient substantially constant vacuum filtration filter pressure to the monospheres to obtain crystalline homogeneously packed monospheres. As pointed out in Applicant's specification, it is necessary for the vacuum pressure to be substantially constant in order to obtain the homogeneously packed monospheres.

It is also important to appreciate that the present invention is directed specifically to the production of opal-type or inverse opal-type crystals. Prior to the present invention, monospheres with a desired particle size and uniformity were assembled into closely packed monospheres by sedimentation or centrifugation, as evidenced by the primary reference Gaskin et al., patented in 1970, and also the more recent patent of Zakhidov et al. U.S. 6,261,469, column 6, lines 40-42. Thus, although there are a host of different types of known chemical engineering separation techniques for separating fluids from solids, only the techniques of sedimentation and centrifugation for packing of monospheres have been suggested by those of ordinary skill in the art prior to the present invention. For good reason, the fact that the monospheres are exceedingly small, a particle size of 20 nanometers to 30 microns and they must be homogeneously packed so as to obtain the desired opal-type effect. Consequently, the prior art processes were not only delicate operations, but also successive batch operations.

In this light, Applicant has developed a substantially flat moving filter system which unexpectedly can obtain the closely packed monospheres in a homogeneous manner in a relatively short time as compared to the prior art processes. Note that in the example of present specification, only 30 minutes were required in order to achieve the desired result, as compared to the much longer times set forth in the prior art sedimentation techniques. Accordingly, Applicant has developed a novel concept that monosphere packing could be accomplished with a moving bed and this was not at all foreseeable nor desired prior to the present invention. It is Applicant and Applicant alone who conceived of the possibility of providing a moving bed filtration system or a vacuum filtration zone under sufficiently constant vacuum filtration pressure to obtain crystalline homogenously packed monospheres.

That the references do not suggest Applicants' invention is clear from the following discussion thereof:

Gaskin et al. U.S. 3,497,367

This patent dated February 24, 1970 states on column 2, lines 47-52, the following:

> "The packing of the particles into ordered close-packed arrays may be achieved by sedimentation techniques or by a combination of sedimentation onto a flat or curved surface with concurrent removal of the suspending medium."

Details of these techniques are set forth on column 6, lines 35-73, and in the examples. In essence, a centrifuge is employed to obtain an intermediate cake which is then dried for an extended period of time (one month in example 2), or in the alternative, a settling cylinder is employed for an extended period of time (eight weeks in example 3). Thus, it is seen that these processes used by Gaskin et al. do not involve a horizontal moving belt, require lengthy drying times, and are relatively tedious. Gaskin et al. teaches that it is rather a delicate and time consuming mission to obtain crystalline homogeneously packed monospheres. On information and belief, in the absence of Applicants invention, one of ordinary skill in the art would have thought it to be foolhardy to attempt to obtain such crystalline packed monospheres on a moving belt.

Also, the Gaskin et al. centrifugation process, though incorporating a relatively rapid first step, would not be amenable for the production of crystalline monospheres having a particulate binder in between the spheres. By centrifugal action, the smaller binder particles would be separated from the larger spheres.

Nolte 4,191,805

This reference teaches a system of forming a layer of material from a solution containing the material and a solvent. Essential to this system is the use of a semi-permeable membrane which permits the solvent vapor to escape from the solution. This semi-permeable membrane is placed at the bottom face of a mold while the top of the mold is open to the atmosphere. By virtue of this system, solvent vapor escapes from both the bottom of the mold and the top of the mold, thereby providing a very uniform layer of the resultant materials. Inasmuch as Gaskin et al. does not employ a solvent solution of a material, but instead is directed to the formation of arrays of crystal opal-type materials, it is respectfully submitted that this reference would not be of any interest to one of ordinary skill in the art of producing opal-type crystals.

Furthermore, the Applicant employs filtration through a porous filter, wherein the aqueous fluid separates through as a liquid not as a vapor. Note that Applicant's claim calls for filtration, not vapor diffusion. Also, it is seen that the reference process is used for the production of layers of intumescent material, and in particular for making fire-screening glazing panels comprising a layer of intumescent material bonded between to vitreous sheets (column 4, lines 51-57) which, is completely non-analogous art compared to the formation of opal-type crystals.

Bagg et al. U.S. 3,617,437

This reference is directed to the separation of composite materials and is particularly concerned with aligning fibers, including whiskers (that is elongated single crystal fibers having a length to diameter ratio of at least 10 and generally at least 100) from a random mass of fibers. It is important to have the fibers aligned so that they can provide an increased strength to the materials into which they are incorporated. The resultant composites are manufactured into prepegs which can be shaped without the necessity of applying high pressure from large and expensive molds. By such a system, large structures such as rocket motor casings can be produced as well as light weight honeycomb structures particularly in airframes (column 3, lines 18-35). To produce the desired alignment of the fibers, they are incorporated in a <u>viscous</u> liquid and the resultant dispersion is passed through an orifice so that the fibers are at least partially aligned and then the dispersion is laid upon a moving permeable surface having a velocity of at least that at which the fiber dispersion leaves the orifice and the viscous liquid is then withdrawn through the permeable surface by suction sufficiently rapidly for the alignment of the fibers to be maintained. As stated on column 2, lines 37-44, a very high degree of alignment may be obtained provided that the bed is moved at a velocity greater than the terminal velocity of the aligned fiber dispersion, and a better alignment of a greater weight of fibers per unit volume of viscous carriers is obtainable with an increase in the ~~velocity~~ viscosity of the carrier (column 2, lines 45-47). Suitable viscous liquid carriers include glycerine, glycerol and aqueous solutions thereof (column 2, lines 34-38). After removal of the viscous liquid forming the original dispersion the fibers are dried and formed into a sheet and then impregnated with a synthetic resin. (Column 2, lines 58-65). In contrast Applicant's invention utilizes a non-viscous water suspension, does not require an intermediate drying step or impregnation with a synthetic resin.

Accordingly, this reference does not address any problem connected with the formation of packed opal-like crystals but rather proposes a process for providing aligned fibers for the production of prepegs which can be used for such products as rocket casings. Thus, this reference, just as in the case of the above discussed Noble reference is non-analogous. Furthermore, in Applicant's invention it would be counterproductive to provide a viscous solution which would impede the ability of the spheres to be closely packed. The three dimensional packing of monospheres is significantly different from the alignment of fibers.

Accordingly, the above discussed secondary references are directed to completely different problems, using completely different materials. Thus, one of ordinary skill in the art interested in producing crystalline opal-type packed monospheres would not be motivated by any stretch of the imagination to utilize the teachings of either of the above discussed references, and even if the teachings were used, a substantially different process would result.

Zakhidov et al. U.S. 6,261,469

As stated at the beginning of these remarks, this reference on column 6, lines 33-42 underscores the novel concept and patentability of the present invention insofar as this reference does not deviate from the 30 year old teachings of Gaskin et al. of packing the SiO_2 spheres by sedimentation whose rate can be enhanced by centrifugation. Conversely, Applicants do not dispute the fact that this reference relates to inverse opal-type packed bodies.

In summation, there would be no motivation for one of ordinary skill in the art to alter the teachings of 1970 teachings of Gaskin et al. or the 2001 teachings of Zakhidov et al. in order to provide a system of vacuum filtration on a moving belt of a water suspension of monospheres much less would there by any expectation of success in achieving crystalline homogeneously packed monospheres.

Dependent Claims

Whereas it is respectfully submitted that all the dependent claims provide an additional layer of patentability to the claims upon which they are dependent, Applicant wishes to point out that claims 3 and 8 are particularly unobvious in view of the manipulative step of infiltrating the packed monospheres while they are on a moving bed membrane and while a vacuum filtration pressure is being applied to the packed monospheres. In addition, those claims dealing with the layer thickness of the bed of, i.e. claims 13-15 and 17-20 are also particularly unobvious. Finally, new claim 21 sets forth the dimensions of the pores of the porous filtration membrane as being equal to or slightly smaller than the spheres to be filtered, support being found in the specification on page 5, line 8.

In view of the above remarks, favorable reconsideration is courteously requested. However, if there are any residual issues which can be expeditiously resolved by a telephone conference, the Examiner is courteously invited to telephone Counsel at the number indicated below.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

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